Energy Efficiency in China: Glorious History, Uncertain Future

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On the Occasion of the Commemoration of Art's Career and the Rosenfeld Effect

April 28, 2006

Part I: Glorious History

preceded in good dialectical fashion by an inglorious earlier history

Part II: Energy Crisis in China: 2001 to present

repeat of much earlier "inglorious history"??

Part III: The Future:

What might happen? What is to be done to end the crisis?

Addendum on Oil

Executive Summary (Part I)

- Things were bad in energy (for 3 decades)
- Deng Xiaoping came to power
  - A group of academics suggested a new approach to energy
  - Deng listened!
- Things were much better (for 2 decades)
- The market became king
  - Energy went off track again
- There are solutions
  - The Chinese government and Communist party are responding, somewhat in the manner of Deng

Part I: three phases

- *Phase I*

  "Soviet Style" Energy Policy (1949-1980)

- *Phase II*

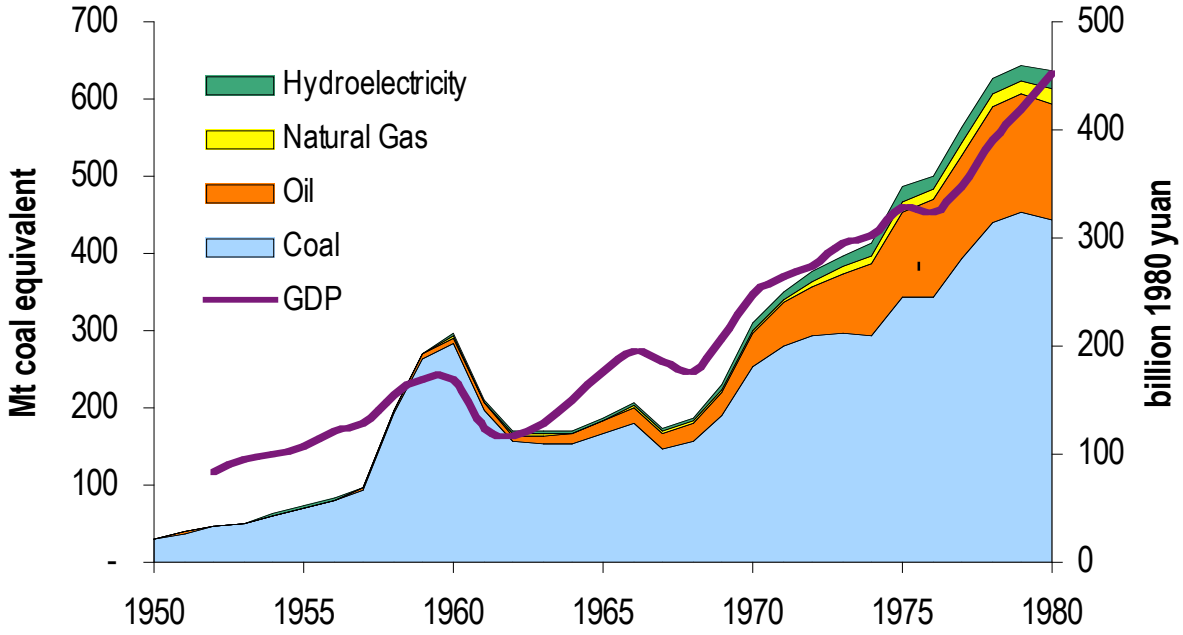
  Deng's Initial Reforms (1981-1992)

- *Phase III*

  Transition Period (1993 to 2001)

Phase I: "Soviet Style" Energy Policy (1949-1980)

- Single objective was rapid energy supply growth
- Energy prices greatly subsidized
- Central allocation system provided energy primarily to industry
- No attention to environment
- **Result:** one of the world's least efficient (and fastest growing) energy systems



Energy Output and GDP, 1950-1980

Source: NBS

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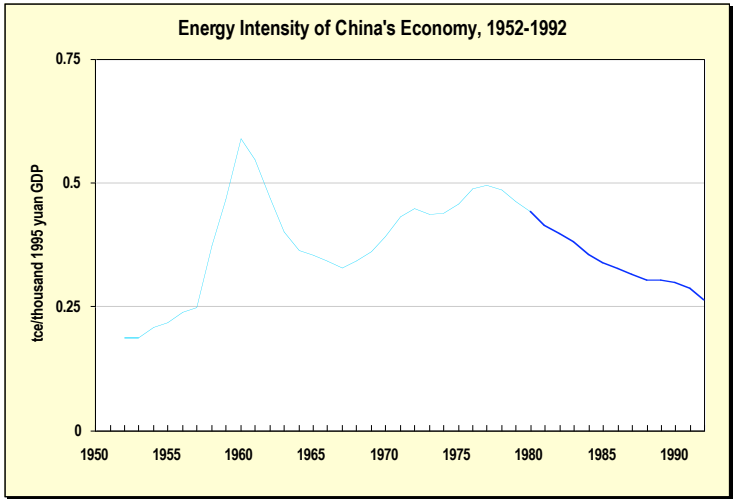
Phase II: Deng's Initial Reforms (1981-1992)

- Key meeting among more than 100 non-governmental energy experts in 1980 stated:
  - China energy policy in crisis
  - need for radical reform
  - major changes identified:
    (1) energy price reform, and
    (2) serious attention to energy efficiency



- Government quickly implemented reforms in Sixth Five-Year Plan (1981-1985)

Source: NBS

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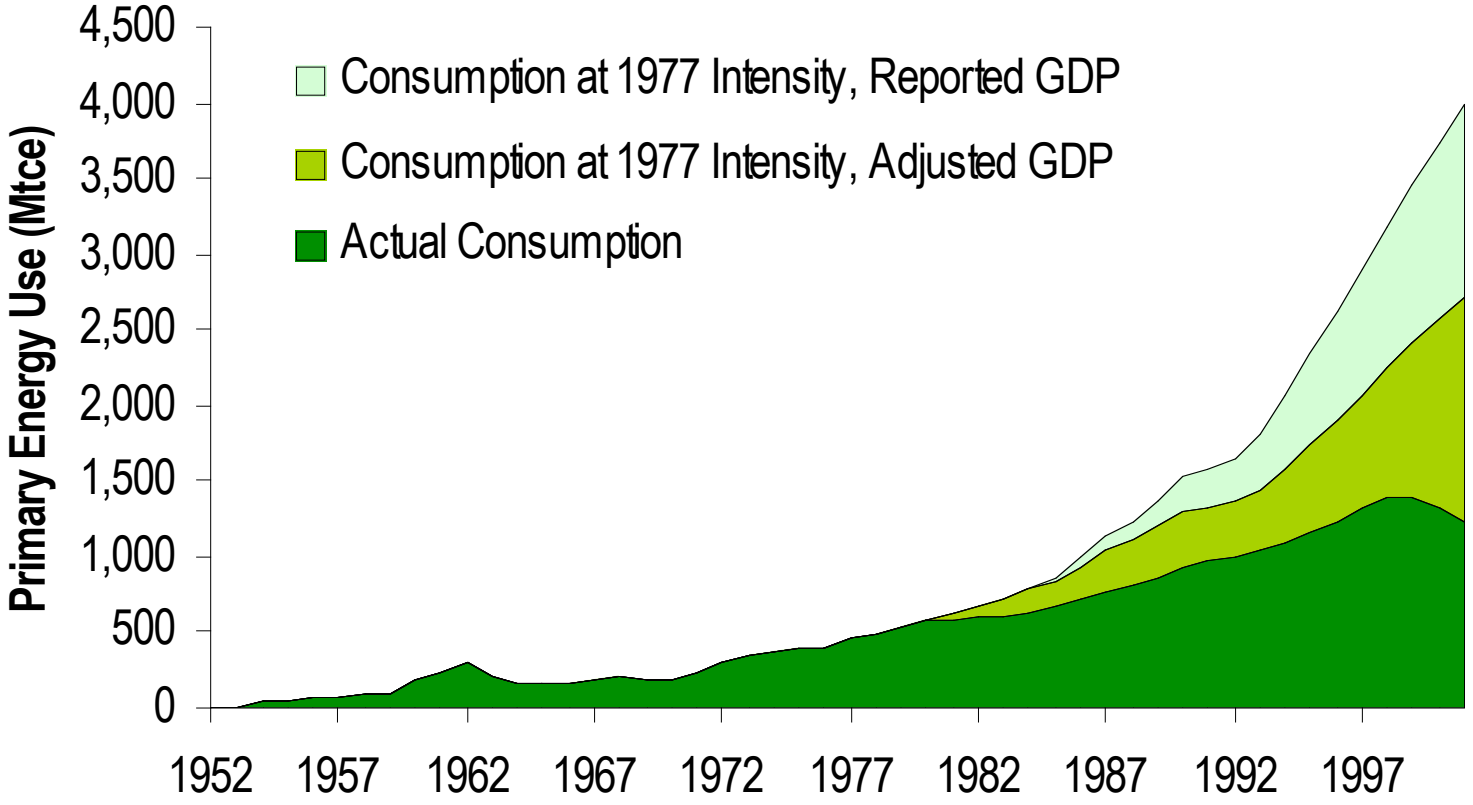
Energy-conservation policies & measures in Phase II

- **Energy Management**
  - —factory energy consumption quotas
  - —factory energy conservation monitoring
  - —efficient technology promotion
  - —close inefficient facilities
  - —controls on oil use
- **Financial Incentives**
  - —low interest rates for efficiency project loans
  - —reduced taxes on efficient product purchases
  - —incentives to develop new efficient products
  - —monetary awards to efficient enterprises
- **R D & D**
  - – funded strategic technology development
  - – funded demonstration projects
- **Information Services**
  - – national information network
  - – national, local, and sectoral efficiency technical service centers
- **Education & Training**
  - – national, local, and sectoral efficiency training centers
  - – Energy Conservation Week
  - – school curricula

Investment in energy efficiency and other policies greatly reduced China's energy intensity (1980-2000)



Energy Use, Actual and Projected at 1977 Intensity, 1952-1999

Source: NBS

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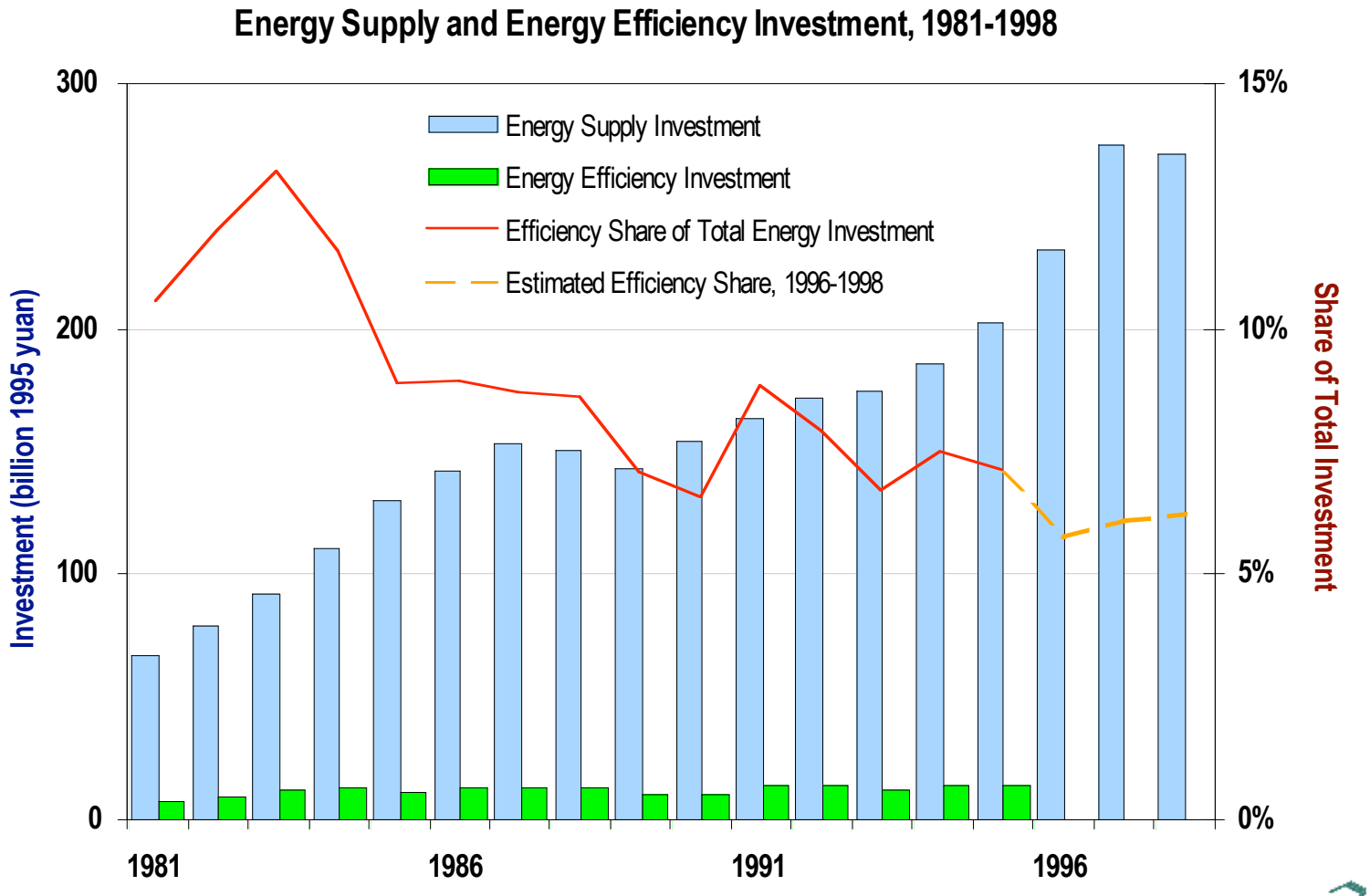
Energy efficiency investment is stable, but declining as share of total investment



N.B. Only partial data on energy efficiency investments after 1995 are available. These partial data informed the estimates presented here of efficiency's shares of total energy sector investment for 1996-1998. All investment data are for state-owned units only.

Source: NBS, SPC

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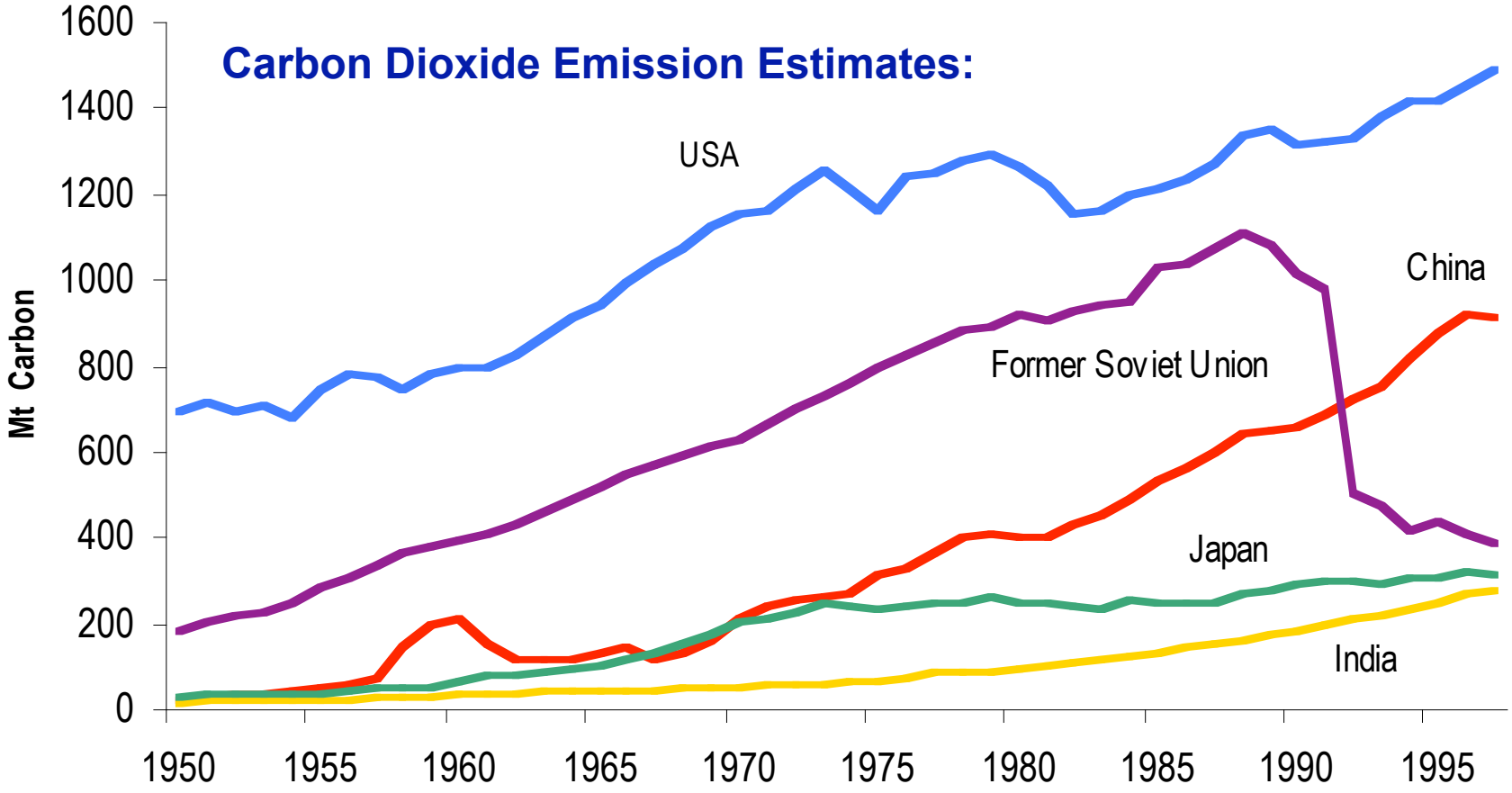
China's CO_2 emissions would have surpassed the US if energy intensity had not declined



Source: ORNL

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Phase III: Transition Period (1993 to 2001)

Rapid movement towards market-based system…

—Dramatic energy price reforms

- coal prices deregulated
- higher oil prices (approach international levels)
- sharp rises in electricity prices

—Enterprise reforms increased price sensitivity

…but past successes in improving energy efficiency were based on mechanisms now gone or disappearing…

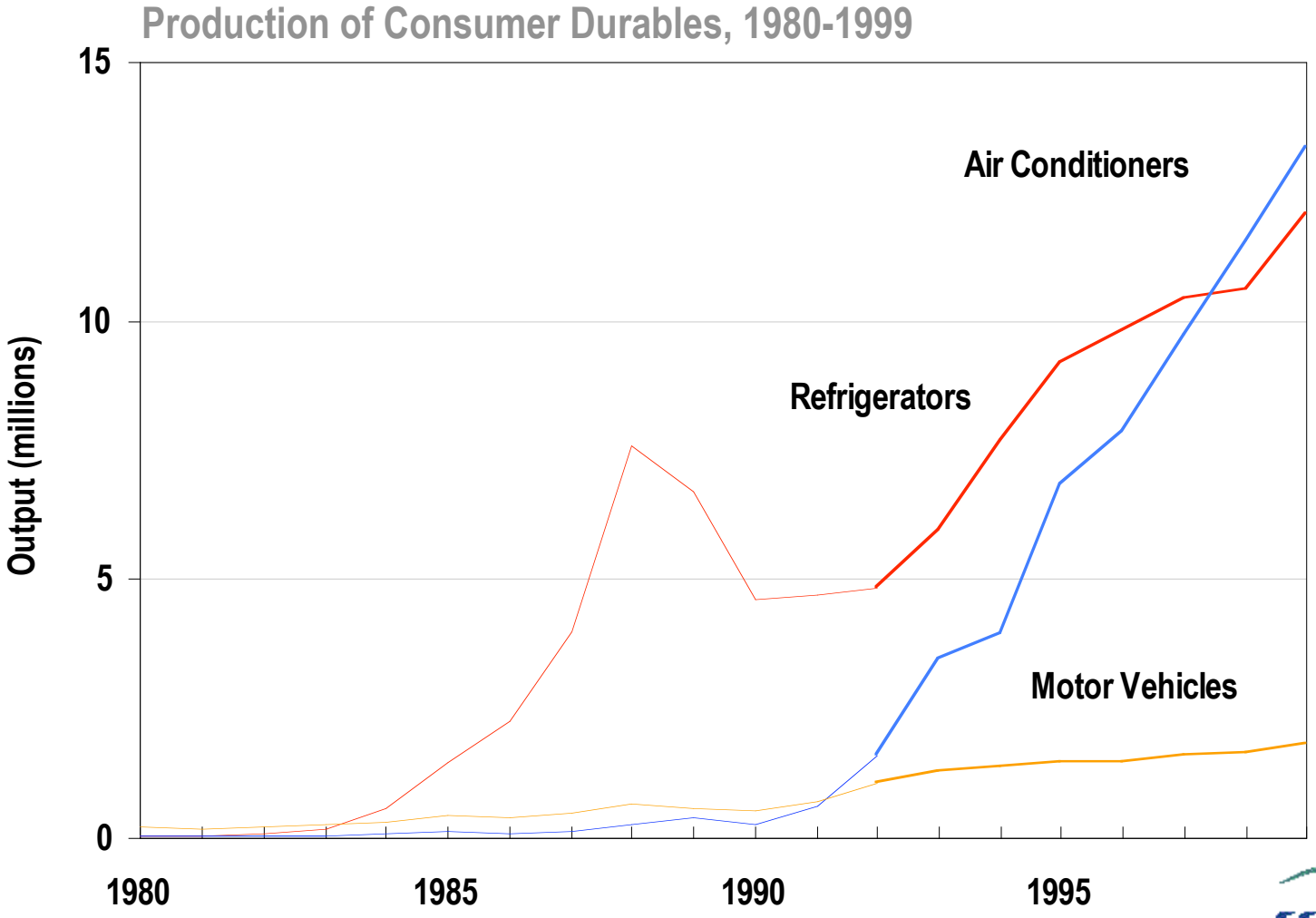
—Elimination of energy quotas lessened incentives for monitoring

—Difficulty in continuing energy efficiency loan subsidies

—New tax code (1994) eliminated tax breaks for efficiency

…thus many challenges remain.

Take-off of consumer goods highlights the need for efficiency standards



Source: NBS

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Part II: Energy Crisis in China: 2001 to present

repeat of much earlier "inglorious history"??

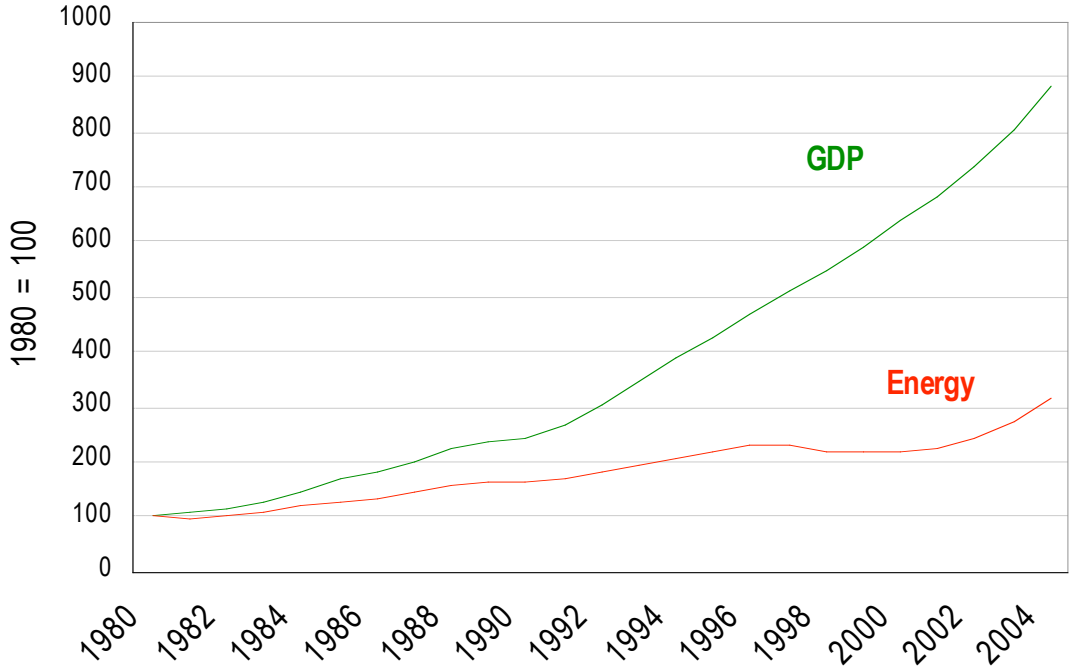
Executive Summary (Part II)

- China faces a serious **new energy crisis**
  - — Most Chinese see the **energy shortage** as the crisis
  - — The real crisis is in **energy policy** (just as in 1979)
- The key issues: how can **investment** be attracted to energy efficiency and how can **government policy** spur such investment?
- Unless this problem is solved, it is unlikely that China will achieve its economic goals for 2020
  - — The **environmental consequences** of energy policy failure are truly frightening
  - — Rapid energy growth portends **economic consequences** of equal concern

Current Energy Crisis

- **Energy demand growing** very, very fast
- In 2004, **widespread power shortage (24 of 31 provinces)**
- **Soaring coal prices**
- **Transportation bottlenecks** for coal
- Significant **economic losses**
- **"Surge" in oil imports especially as oil is used in place of coal**

China has demonstrated that a rapidly developing nation can decouple energy and GDP growth with bold policies initiated in 1980



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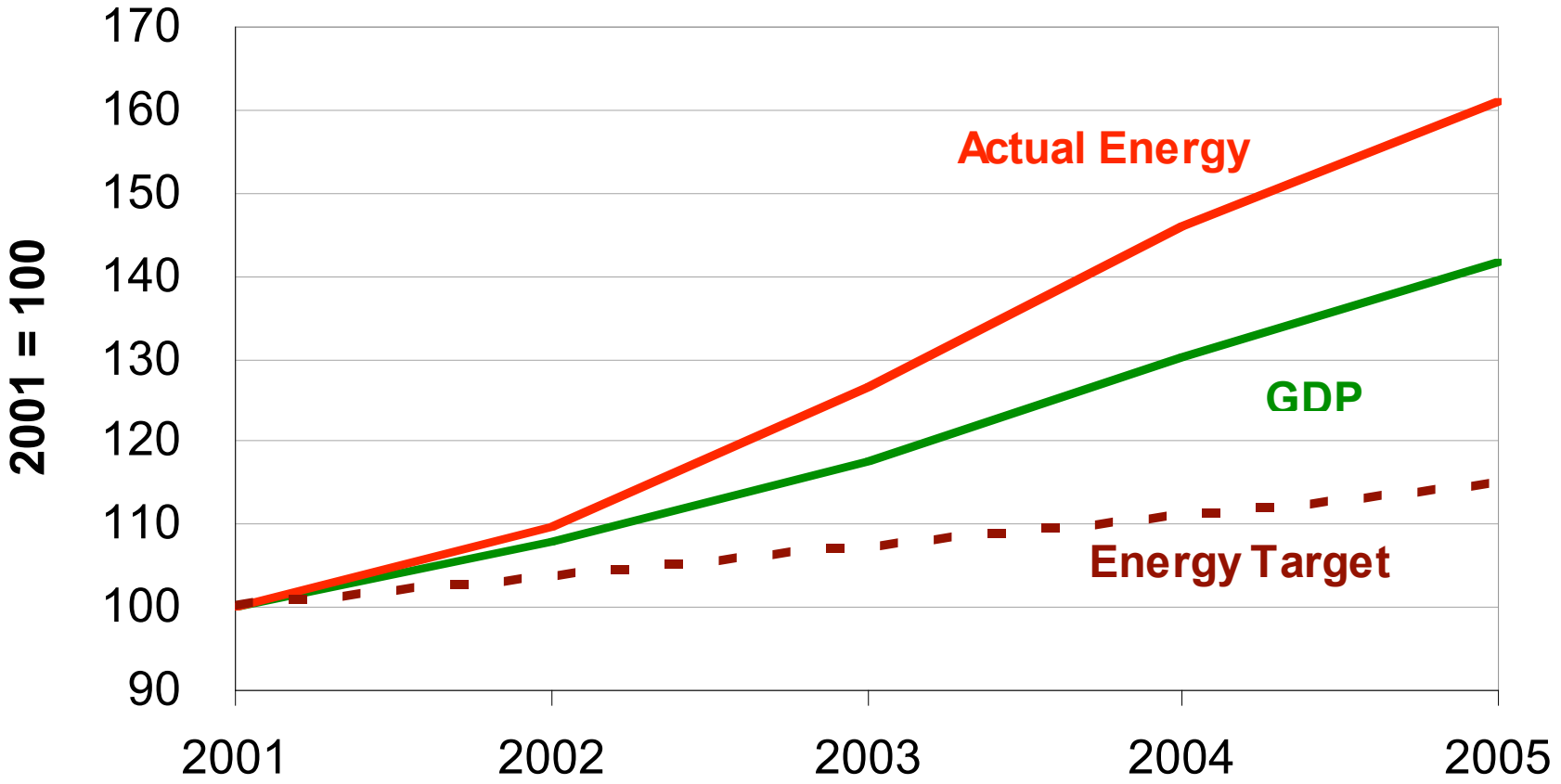
Since 2001, energy use has grown much faster than GDP, reversing patterns from 1980 to 2000



Source: NBS, China Statistical Yearbook, various years; China Statistical Abstract 2005; growth estimates extrapolated from mid-year production data for 2005.

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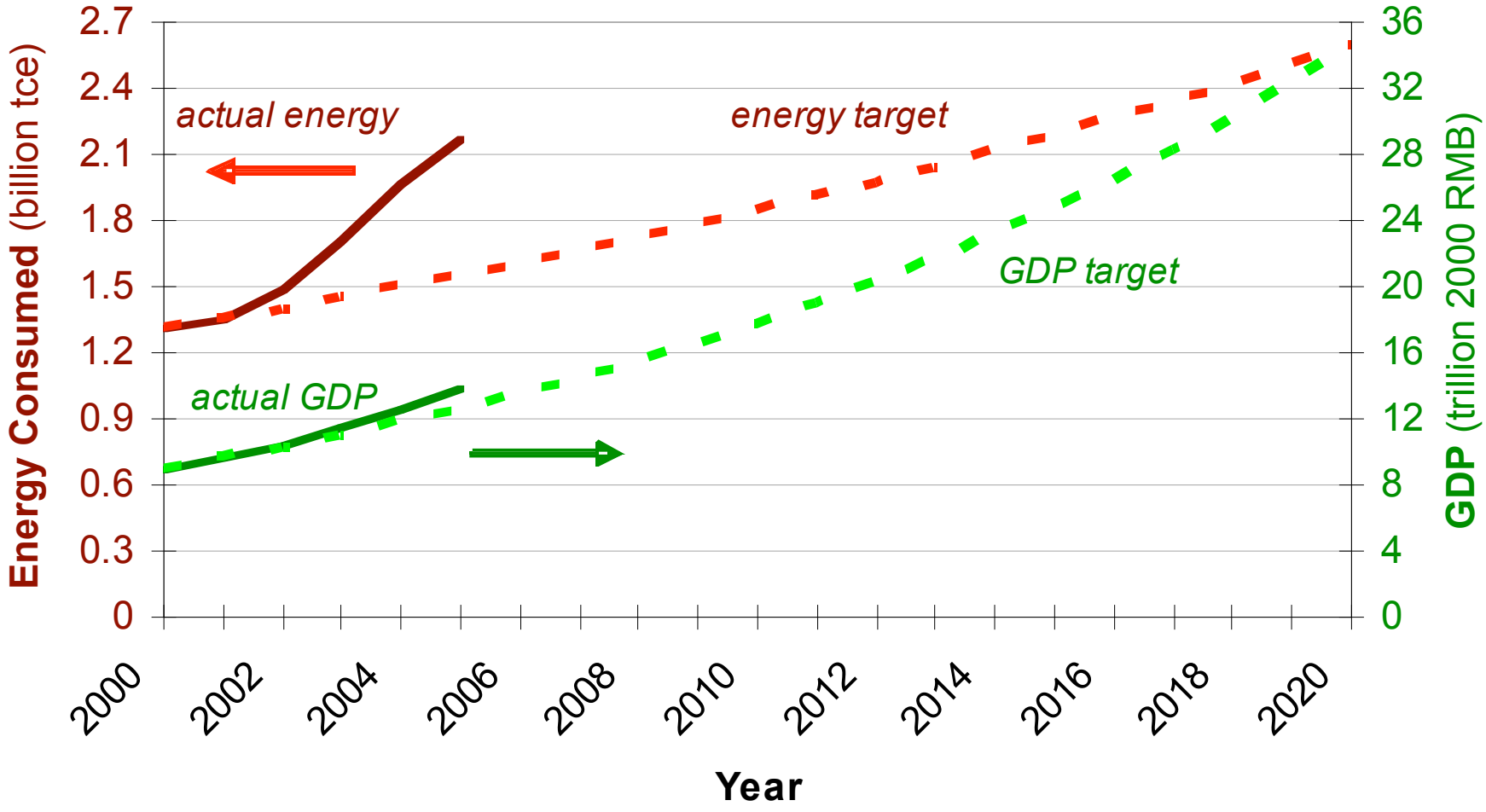
China's Energy and Development Goals for 2020

Goals (compared with 2000)

- **GDP -- Quadrupling**
- **Urbanization -- 65% vs 35% now**
- **Energy Use -- Doubling**

But energy demand is now growing so rapidly that the development goals are in jeopardy!

Another view of the data



Source: NBS, China Statistical Yearbook, various years; China Statistical Abstract 2005; growth estimates extrapolated from mid-year production data for 2005; targets announced by NDRC.

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China's Response: Fast and Furious

Boom in power plant construction

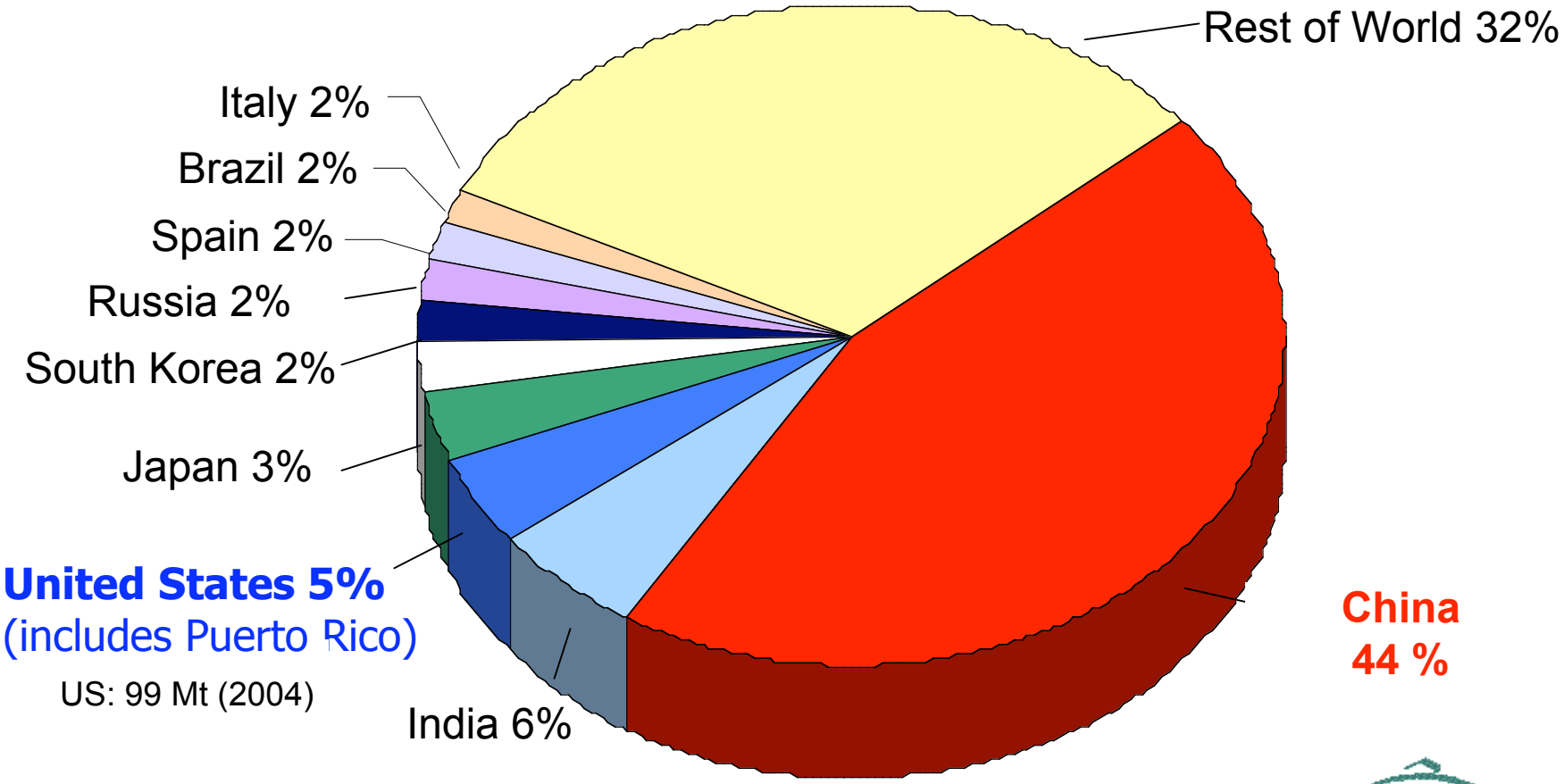
— 50-70 GW added each year!!

— Mostly coal-fired

Growth in heavy has been extraordinary in past five years: industrial efficiency especially critical

- Consumes >60% of energy
- Technical complexity: many different types of processes
- Extraordinary growth in past five years
- Existence of many old, legacy industrial facilities

Cement Production Worldwide: 2004



Sources: U.S. Geological Survey, 2005. Mineral Commodity Summaries: Cement; Cui, Y., 2006

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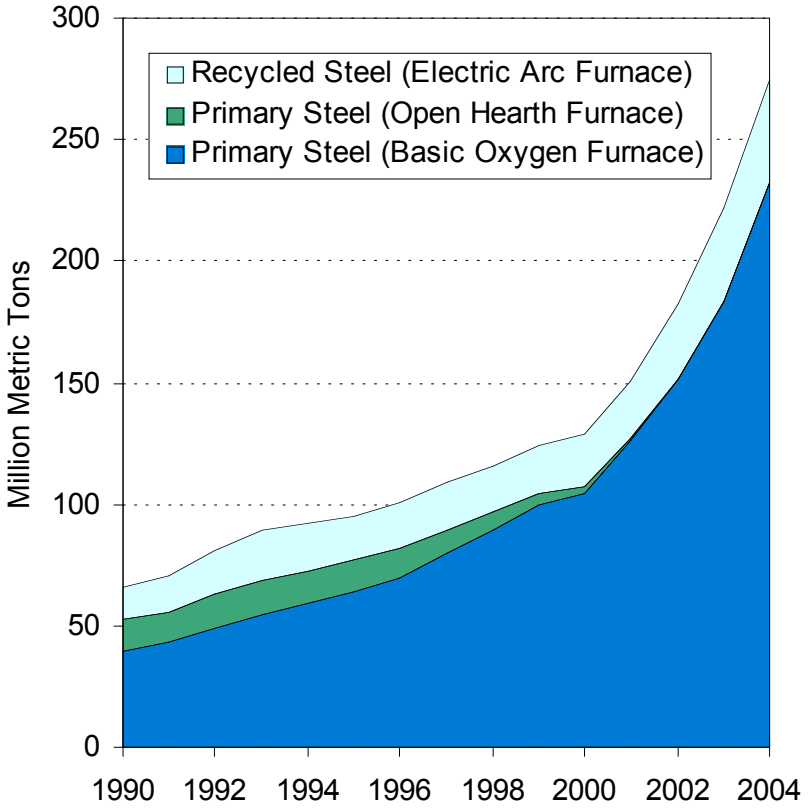
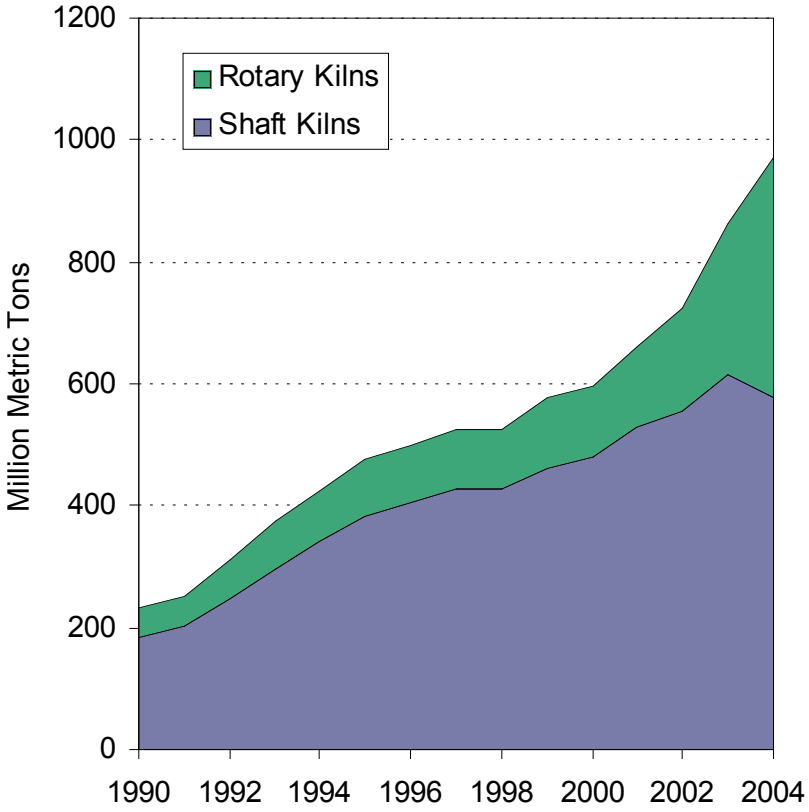
China is the world leader in the production of many industrial commodities

China's Crude Steel Production 1990-2004



China's Cement Production 1990-2004



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Part III: The Future

What might happen? What is to be done to end the crisis?

Executive Summary (Part III)

- Things could get worse
  - —Actually they can't, but they could continue on the present path for some time
- Things could get better
  - —It now appears they will!!

China's National Energy Strategy

"Energy development and efficiency have equal role (emphasis on efficiency)"

- But supply investment at ***RMB 424 billion*** ($ 50B) while energy conservation investment at ***RMB 23 billion*** ($3B) in 2003 **!!**

Energy Investment

- Energy supply investment is ~18 times energy efficiency investment
- Energy efficiency investment needs to increase from $3B to $25B per year (avg over next decade)

China's government now recognizes the urgency of energy efficiency

- The reform period (1980-2000) showed that energy efficiency was essential to achieve economic goals ***(Deng Xiaoping)***

- The current leadership recognizes the same imperative (*Plenary of the Communist Party, Nov, 2005)—Premier* ***Wen Jiabao***:

"Energy use per unit of GDP must be reduced by 20% from 2005 to 2010"

- Statement reiterated by the National Peoples Congress (March 2006)

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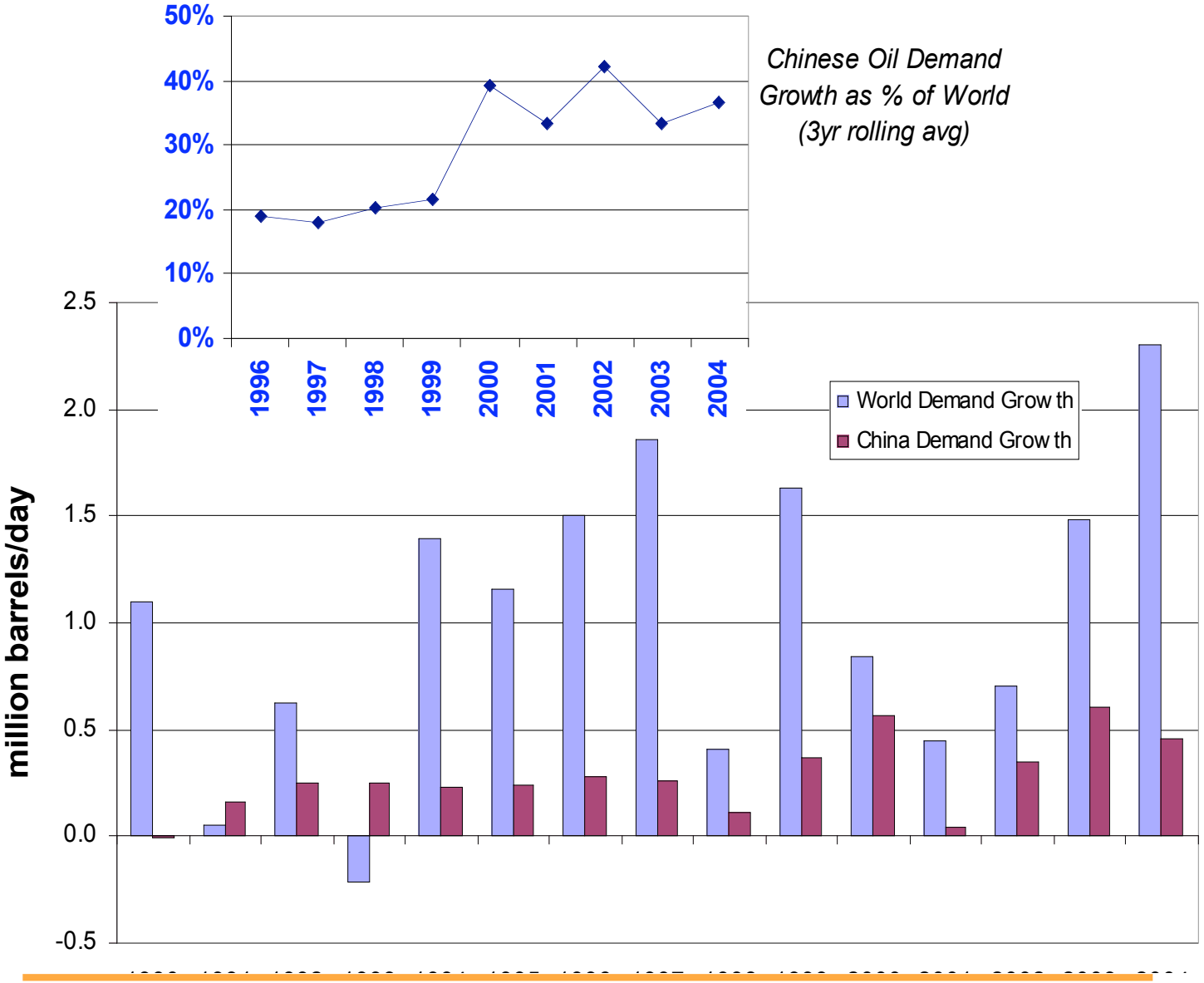
THE END

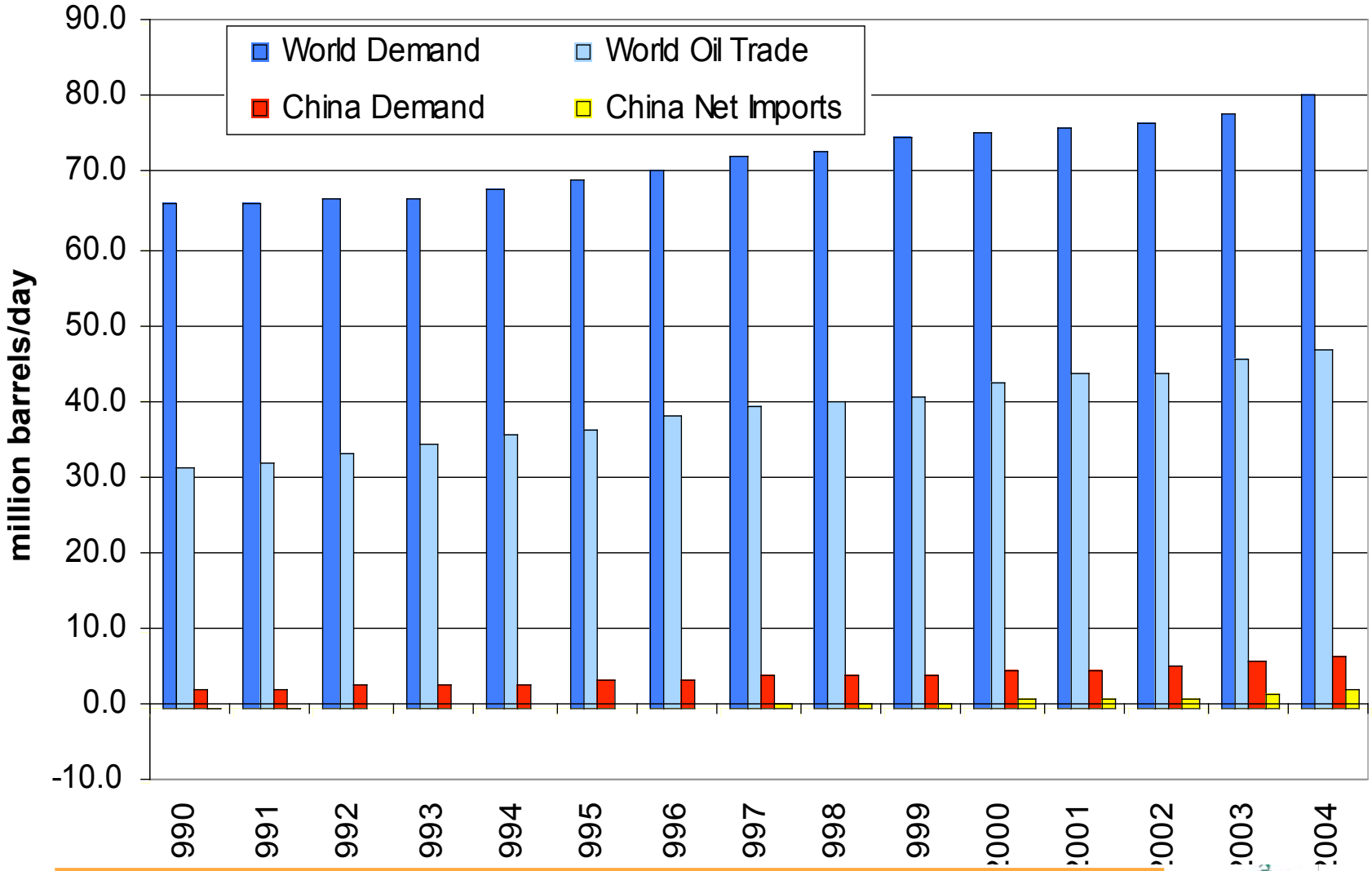
(almost)

Skills Only Found in China


中国石油
加油中

Addendum on Oil


50%
40%
30%
20%
10%
0%
1996
1997
1998
1999
2000
2001
2002
2003
2004
Chinese Oil Demand Growth as % of World (3yr rolling avg)
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
million barrels/day
World Demand Growth
China Demand Growth


90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
-10.0
million barrels/day
World Demand
World Oil Trade
China Demand
China Net Imports
990
991
992
993
994
995
996
997
998
999
2000
2001
2002
2003
2004